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Mitigating electrostatic pinholes in natural gas PE distribution pipe for DIMP IM requirements

What creates pinholes in PE gas pipe?

Pinholes are caused by the buildup of static electricity inside PE pipe. PE's physical characteristics naturally resist electrical charges. This property is called its "Dielectric Constant". Think of it as PE's ability to act as an electrical insulator. Medium Density PE has a dielectric constant of approximately 510 volts per thousandth of an inch thickness of PE. Therefore, for example, if a medium density PE pipe wall is 5 thousands of an inch thick, then the pipe wall can withstand 5 x 510 or 2550 volts of electricity before the PE pipe wall material is physically broken down by an electrical charge.

When the voltage of the static inside the buried pipe exceeds the dielectric constant of the wall thickness of the pipe, the interior static arcs through the pipe wall to the earth's ground. The heat of that arcing static melts the pipe wall creating a pinhole leak.

Why are pinholes created in certain areas?

While the physics of how static is created is well known, it is not known what causes static to build up to levels inside PE pipe that can regularly arc through pipe walls in specific areas of PE fuel gas systems. However, you can identify those areas which regularly build up these high levels of interior static by your company repeatedly having to replace PE pipe in certain areas due to pinhole leaks. Our field experience is that in areas of your system you have identified having pinhole leaks will continue to have pinhole leaks.

What are the characteristics of systems with pinhole leaks?

As far as we can ascertain, Ionix Gas Technologies has done more research and field remediation of pinhole leaks in PE fuel gas systems than any company or research organization. Based upon our field observations we have found:

1. Pinhole leaks are not caused by operational procedures, material defects or design parameters.
2. Pinhole leaks cluster in groups of pipes.
3. Pinhole leaks cluster in geographical areas.
4. Pinhole leaks cluster in service lines.
5. Most pinhole leaks occur in 1" or smaller plastic lines.
6. There seems no pattern for the number of pinhole leaks in pipe. We've seen 2, 3, 4 or more pinholes in the same pipe.
7. Pinhole leaks have only been observed in PE pipe material.
8. Pinhole leaks are not particular to a brand of pipe. We've seen pinholes in 3 different brands of pipe in the same service line.
9. Service areas experiencing pinhole leaks will continue to have pinholes unless static is eliminated inside the affected areas. A pinholing problem in your system will not just go away naturally.

How are pinholes eliminated?
Since pinhole leaks are created by internal static electricity, to control pinhole leak generation you must eliminate the interior pipe static in the affected service areas. That is accomplished by installing Ionix Static Suppression Cartridges upstream of the affected area. When gas is treated by Ionix, interior pipe static is eliminated from treatment point to burner tip. Pinholes cannot occur since there now is no interior pipe static to arc through the pipe wall and create pinholes.

How can I document the reduction in pinholes?
If you have identified pinholes in your system, these pinholes have accumulated over time. Also, since these are small leaks, there are probably many undetected leaks.

When you initially install Ionix to mitigate pinhole leak creation, for approximately 6 months you will probably not notice a change in the number of pinhole leak reports in the treated area. However, after 6 months of Ionix deployment, the pinholes leaks you do detect will be legacy pinhole leaks - leaks prior to deployment of Ionix. 6 months after deployment of Ionix you should begin to see a continual decline in pinhole leak reports in the affected area as you discover and repair the least detectable pinhole leaks.

Once the pinholes are repaired, can I discontinue using Ionix?
The mechanism which creates interior static in your affected system area is not fixed with the deployment of Ionix Static Suppression system because it is not known what that mechanism is. Ionix can only eliminate the interior pipe static inside your affected system generated by that unknown mechanism which in turn creates pinhole leaks. If you discontinue Ionix, static and its resulting pinholes will return. Ionix is a control of symptoms – not a cure.

What are my statutory requirements to prevent pinhole leaks?
Part 192.1007 Gas Distribution Pipeline Integrity Management (IM)

(5) (d) Identify and implement measures to address risks. Determine and implement measures designed to reduce the risks from failure of its gas distribution system. These measures must include an effective leak management system (unless all leaks are repaired when found).

If you have discovered pinhole leaks in your system you are required by statute to manage (reduce) them.

How do I deploy Ionix?
Since every system is different, every Ionix deployment is different. Contact Ionix for a short outline of how to deploy an Ionix Static Suppression program for your systems needs.